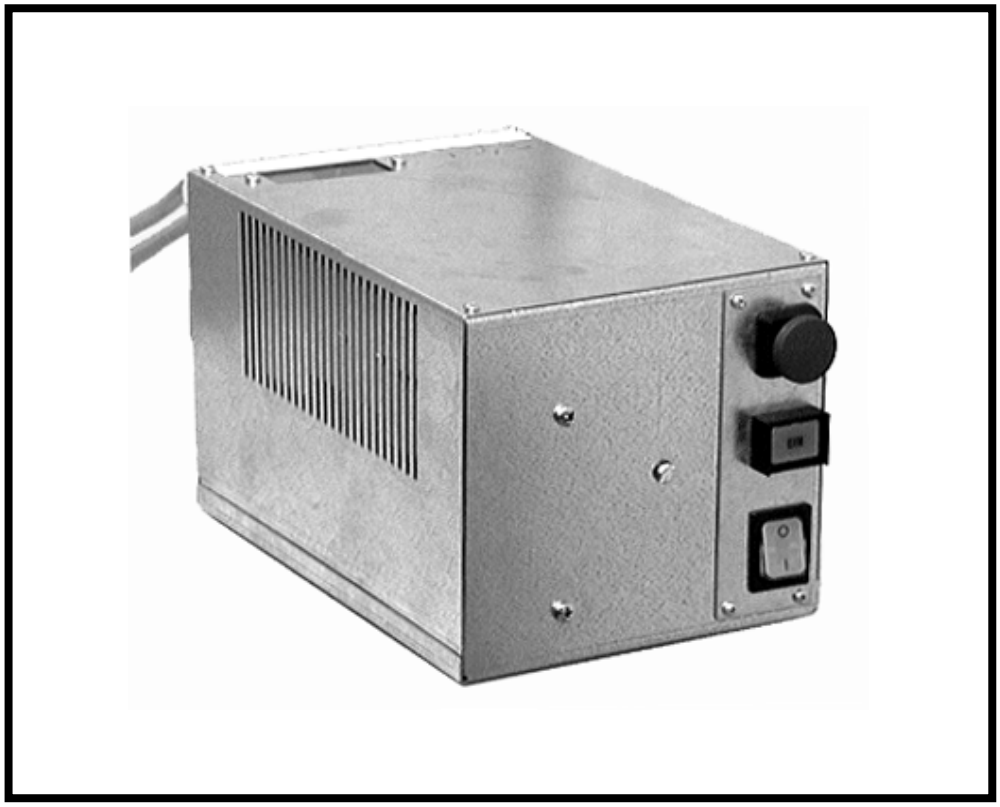
isel automation
Von der Komponente zum System

isel Power Block 300-C
isel Power Block 450-C
isel Power Block 600-C



Hardware Manual

B.308059/2000.11/E

On this Manual

Various symbols are used in this Manual to quickly provide you with brief information.

Danger	Caution	Note	Example	Additional Information
				

In spite every care, printing errors and errors can not be excluded.
We welcome any suggestions and remarks on faults.

isel machines and controllers are CE-coforming and adequately labeled.
Commissioning of all other machine components is not allowed until all corresponding demands, on which the CE-safety guidelines have to be applied, are fulfilled.

isel*automation GmbH & Co. KG* assumes no guarantee on machines that have been altered or modified.

The electromagnetic compatibility test only applies to the original configuration of the machine supplied ex works.

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1 Introduction

Model PB xxx-C *isel* Power Blocks are rack-mounting units designed especially for the power supply of *isel* power units (CV 4, C 142-4). The steel-sheet-enclosed devices (dimensions W = 150 x H = 140 x D = 220 mm) incorporate a 650 VA toroidal-core current transformer with starting current limitation and mains filter, as well as a p.c. board for providing auxiliary voltages and safety-relevant function elements.
The Power Blocks are offered in three different variants that differ only by the height of the load voltage (supply voltage of power output stages).

PB 600-C	Voltage output 68 V/7 A
PB 450-C	Voltage output 43 V/8 A
PB 300-C	Voltage output 30 V/8 A

Fig. 1: Model PB xxx-C isel Power Block

2 Scope of Supply

The scope of supply of Model PB xxx-C Power Block comprises:

- Power Block with mains supply cable (l = 0.5 m)

3 Safety Notes

- When installing or using the Power Block, please observe the standards laid down in the Certificate of Conformity.
- The instructions and limit values observed by the manufacturer will not provide protection in case of improper use of the device.

In this context, you should observe the following:

... Connect and install the device only when it is turned off and the mains line is removed.

... All work on the device should only be carried out by expert personnel. When doing so, adhere, in particular, to the relevant regulations and instructions of the electrical industry, as well as to the relevant rules for the prevention of accidents.

Relevant standards applicable to the stepper motor controller:

EN 60204 (VDE 0113) Part 1 (1992 Edition)
- Electrical Equipment of Industrial Machines

EN 50178 (VDE 0160)
- Completion of Electrical Power Installations with Electronic Equipment

VDE 0551
- Regulations for Safety Isolating Transformers

EN 292 Parts 1 and 2
- Safety of Machinery

EN 55011 (VDE 0875)
- Radio and Television Interference Suppression, Limit Value B

IEC 1000-4 (Parts 2-5)
- Inspection, Test and Measuring Methods for Noise Immunity

The Power Blocks require the following supply voltages:

PB 600-C	AC 230 V/50 Hz, max. 8 A
PB 450-C	AC 230 V/50 Hz, max. 7.5 A
PB 300-C	AC 230 V/50 Hz, max. 7.0 A

The network transformer has a temperature switch on its primary side, which has a response temperature of 120 °C. When connecting the Power Block, install additional primary fuses. When connecting the device directly to the domestic electrical installation, primary protection of the Power Block is provided by the fuse element (16 A) installed therein.
When integrating the Power Block into a control system (e.g. a control cabinet), an additional primary fuse must be installed. To do so, use exclusively fuses to IEC-127. The mains supply cable is carried into the Power Block via a PG9-type heavy-gauge conduit thread (capacity of terminals: 4 ... 8 mm). The connecting cable must be a double-isolated line.

When installing the Power Blocks, the following considerations should also be observed:

- The Power Block is a rack-mounted unit of class of protection 1.
- The degree of protection of the Power Block is IP 20.
- The installation of the Power Block may only be carried out lying horizontally.
- Primary and secondary lines must be designed as cables (no single lines).
- Primary and secondary lines must be separated by 3 layers of insulating material.
- The Power Block is designed for operation at an ambient temperature of max. 40 °C.

4 Technical Specifications

4.1 Motor Voltage

For supplying the power output stages, Model PB xxx-C Power Blocks provide a non-stabilised DC voltage (DC link voltage). The voltage output is enabled by a safety device with switching relay connected in series.

The safety device constitutes a series connection of control stations which turns on the secondary voltage of the toroidal-core current transformer using a safety relay with positively driven contacts and a series-connected all-or nothing relay. The output voltage of the DC link is connected to WAGO terminals via four separated fuse-elements. The connecting lines connected there are brought off the power supply module via heavy-gauge conduit threads.

To protect the DC link voltage from overvoltage (e.g. by energy recovery in brake mode of the motors), the Power Block is provided with an appropriate protective circuitry (brake chopper). In case of voltages > 80 V, it automatically enables a power resistor converting energy into heat.
When the safety circuit is disabled, the stored energy of the DC link capacitor is discharged via a load resistor.

4.2 Auxiliary Voltage I

This + 24 V auxiliary voltage is provided from the output of a fixed-voltage controller. The input voltage is provided by a double-insulated secondary winding of the transformer. The + 24 V voltage serves for power supply of the signal inputs/outputs, the external limit switch and reference switches, as well as of the control relay of the safety circuit.
The maximum current that can be used by an external load is 0.7 A.

4.3 Auxiliary Voltage II

This + 24 V auxiliary voltage is intended for power supply of the safety circuit. The input voltage is provided from a double-insulated secondary pick-off of the toroidal-core current transformer. The + 24 V fixed-voltage controller is used to limit the output current to approx. 1.0 A.

4.4 Safety Devices

The implementation of the safety circuit is based on a series connection of control stations, e.g. EMERGENECY STOP switch, safety loops and ON button.
The safety-relevant parts act on a relay with positively driven contacts that, in turn, turns on load relays. The load relays are monitored by an opto-coupler acc. to EN 60204 and are designed redundantly.

5 System Description

5.1 Functional Groups

① Auxiliary voltage 1

② Auxiliary voltage 2

③ Four load relays

④ Secondary. conn. 2

⑤ Secondary. conn. 3

⑥ Connection terminal X3

⑦ Safety relay

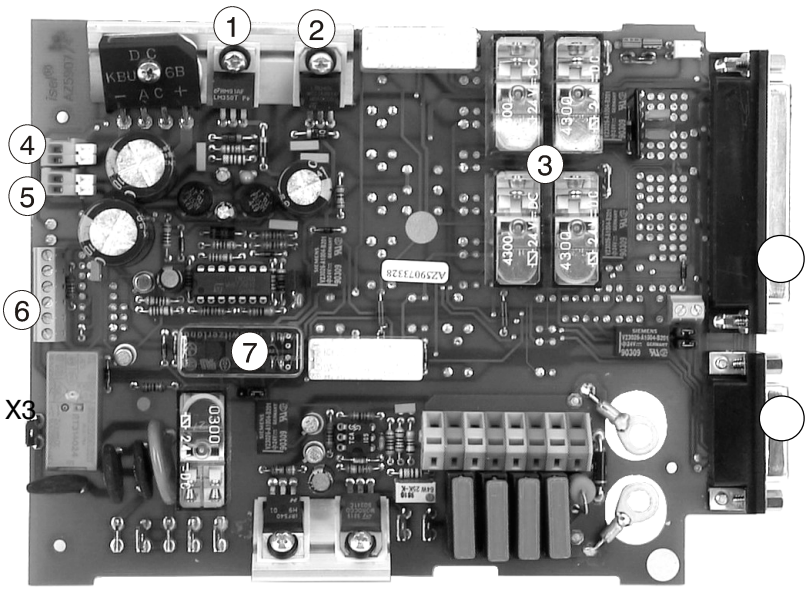


Fig. 2: Functional groups of the Power Block

5.2 Connection and Cabling

5.2.1 Connector X1

For connecting the power units, the Power Block has a 37-pin Sub D female connector.

Signal		Pin	Pin		Signal
GND	**A**	1	20		Not connected
+ 24 V	**A**	2	21		Not connected
Not connected		3	22	**E**	Limit switch
Power output stage disable 1	**A**	4	23	**A**	Limit switch enable
GND	**A**	5	24	**E**	Drive enable
+ 24 V	**A**	6	25		Not connected
Not connected		7	26		Not connected
Power output stage disable 2	**A**	8	27	**A**	Safety circuit o.k.
GND	**A**	9	28		Not connected
+ 24 V	**A**	10	29		Not connected
Not connected		11	30		Not connected
Power output stage disable 3	**A**	12	31	**A**	Load relay monitoring
GND	**A**	13	32		Not connected
+ 24 V	**A**	14	33		Not connected
Not connected		15	34		Not connected
Power output stage disable 4	**A**	16	35		Not connected
Not connected		17	36	**A**	Opto-coupler X1
GND	**A**	18	37	**A**	GND
GND	**A**	19			

5.2.1.1 Signal Outputs (O)

+ 24 V, GND

This is the voltage output of auxiliary voltage I.
The voltage is intended to supply the reference switches of the numerical axes and the opto-couplers in the power electronic unit.

Power output stage disable

This output is intended for disabling (making dead) the stepper motor power output stages. The + 24 V output signal of the Power Block is enabled with the load relay disabled (supply voltage of power output stages switched off) and provided to all connected output stage boards in parallel.

Limit switch enable

The signal output provides a +24 V signal, with the limit switch monitoring circuit by-passed.

By-passing of this safety-relevant functional group is necessary if one or several limit switches are active. This may be caused, e.g. by a mistake in the drive unit (controller) or mechanics or due to faulty operation (see also „Signal Output Enable“).


The signal is only used in conjunction with servomotor power units.

Safety relay o.k.

A + 24 V voltage on connector X1.27 signals that the power supply of the power output stages (DC link voltage) is turned on.
This output signal is the control voltage of the load relays and connected to the plug-in contact; pin X1.9 (GND) is used as the earth reference.

Monitoring load relay

This is a + 24 V output (open emitter) of an opto-coupler that monitors the signals provided from the switching contacts of the redundantly designed load relays. With the DC link voltage switched off (safety relay is disabled) and defective load relays (e.g. contact is welded), the output carries + 24 V potential.

Opto-coupler X1

The output is the status display of the safety circuit. The opto-coupler output is enabled (+ 24 V connected) if the series connection of the safety-relevant controls is operative so that actuating the ON button results in switching the safety relay.

5.2.1.2 Signal Inputs (I)

Limit switches

Limit switches installed on the numerical axes are intended to limit the maximum traversing distances. They are effective directly in the safety chain of the Power Block via relay and, when actuated, interrupt the power boards connected.

For activating the relay, a +24 V signal should be connected to the input of the power block. If the control voltage is not provided, the relay will drop out, interrupting the safety device.

The limit switch signal input is only evaluated in servomotor power units. All limit switches on the interface module of the controller are monitored and carried as a group signal to the Power Block.

Drive enable

For monitoring the readiness for operation of the connected power units or of a control computer, the Power Block expects an enable signal.
The + 24 V signal is effective in the safety circuit of the Power Block via a relay.

5.2.2 Connector X2

The 15-pin Sub D-female connector X2 is prepared for connecting external, safety-relevant controls. EMERGENCY STOP switch, ON button, safety contacts, etc. can be connected here acc. to the assignment below.

Signal	Pin	Pin	Signal
Key switch (n. o. contact)**	1	9	Key switch (n. o. contact)**
ON button (n. o. contact)	2	10	ON button (n. o. contact)
Safety switch (n. o. contact)	3	11	Safety contact (n. c. contact)
Safety contact (n. c. contact)	4	12	Safety contact (n. c. contact)
EMERGENCY STOP switch (n. c. contact)	5	13	EMERGENCY STOP switch (n. c. contact)
Safety relay (GND)	6	14	Safety relay (+ 24 V = enabled)
Potential-free switching contact	7	15	Potential-free switching contact
Load relay monitoring	8		

** is only evaluated in conjunction with servomotor power units

The pin assignment is as follows:

Key switch

A closed contact between X2.1 and X2.9 jumpers the limit switch monitoring. As a result, an actuated limit switch on the numerical axes will not turn off the operating voltage (see also Section 4.2.1.2: Limit Switch Enable).

When using a key switch, make sure that the contact is turned on not longer than absolutely necessary.

The protective devices of the drive axes are disabled! It is imperative to observe the maximum traversing distances of your drive axis. In case of a collision within the mechanics, impairments of the functional performance cannot be ruled out.

ON button

A normally open contact (n. o. contact) between X2.2 and X2.10 will turn on the DC link voltage (power supply of power output stages) if all function elements of the safety chain are active.

Safety switch

Actuating a normally closed (n. c.) switch connected between the contacts X2.3 and X2.11 will turn off the operating voltage of the output stages.
The switch should be chosen and used acc. to EN 418. If the switching contact is not needed, the contacts should be jumpered.

Safety contact

Actuating a normally closed (n.c.) switching contact connected between the contacts X2.4 and X2.12 will turn off the operating voltage.
The switch should be chosen and used acc. to EN 418. If the external switching contact is not needed, the contacts should be jumpered.

EMERGENCY STOP switch

Actuating an n.c. switch of an EMERGENCY STOP switch connected between the contacts X2.5 and X2.13 will turn off the operating voltage. The switch should be chosen and used acc. to EN 418. If the EMERGENCY STOP switch is not connected, the contacts should be jumpered.

Safety relay active

The output is the control voltage of the load relay installed in the Power Block. Thus, a +24 V voltage is present at output X2.14 when the load relay is enabled; earth reference is contact X2.6.

Potential-free switching contact

The outputs X2.7 and X2.15 are connected to a potential-free relay contact within the Power Block. The contact is closed when the DC link voltage (operating coltage of the power output stages) is turned on. It can be used to integrate the Power Block into higher-level safety systems.

Load relay monitoring

With the safety circuit disabled and defective switching contacts of the all-or-nothing relay, this output will provide a + 24 V signal (pulsating DC voltage). Contact X2.6 is used as the earth reference.

5.2.3 Connector X3

The following controls can be connected to the 8-pin board terminal:

1 - 2 EMERGENCY STOP switch
3 - 4 ON button
5 - 6 ON button lamp (lights when the safety circuit is enabled)
7 - 8 Key switch

The function of the switching elements is identical to that of the 15-pin Sub D male connector X2. When connecting the ON pushbutton, make absolutely sure that only one ON switching function may exist acc. to the relevant safety standards and thus a second ON pushbutton may not be connected externally to connector X2 at the same time.

5.3 Status Displays of the Power Block

To display the operating states, the Power Block has four LEDs (V1 to V4)

① LED V1

② LED V2

③ LED V3

④ LED V4

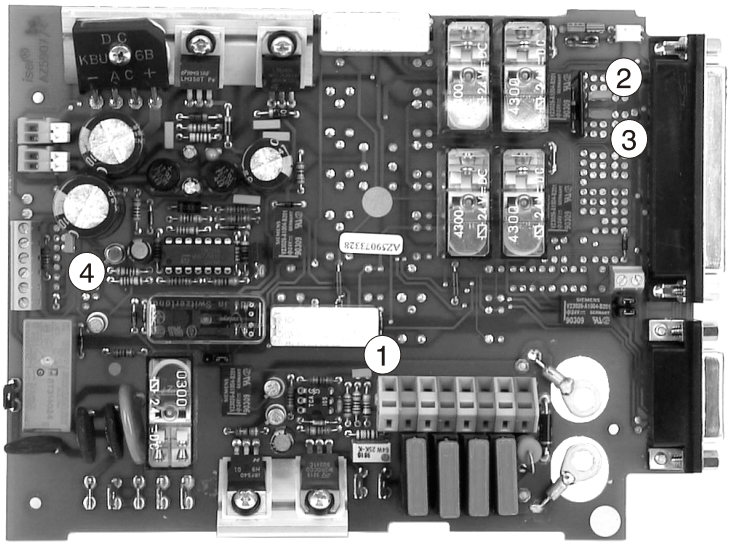


Fig. 3: LEDs of Power Block PB xxx-C

The LEDs are:

V1 LED V1 displays that the brake chopper is active, thus connecting a load resistor in parallel to the DC link capacitor. This operating state can be achieved as a result of two events:

- Overvoltage on the capacitor, e.g. by energy recovery from the connected DC servomotor.
- Connecting the load resistor for fast reduction of the stored energy of the DC link capacitor after disabling the safety circuit.

V2 LED V2 signals that the limit switch input is active (+ 24 V) and monitoring by the safety circuit is provided.

V3 LED V3 lights when a +24 V signal is present at the drive enable signal input and the power output stages thus signal their readiness for operation. The input is effective directly in the safety circuit of the Power Block.

V4 LED V4 lights when the safety circuit is ready for operation, i.e. the following safety-relevant controls are active.

- EMERGENCY STOP switch (external) N. C. CONTACT
- Safety switch (e.g. cover contact) N.C. CONTACT
- Emergency stop switch (internal)
- Safety contact (e.g. kick-strip, lighting trunking) N.C. CONTACT

5.4 Coding Field

The control board of the Power Block has three coding jumpers that can be used to adapt the Power Block to different operating conditions.

Jumper 2 **Jumpers 1 and 3**

Fig. 4: Coding fields and fuses of the Model PB 600-C Power Block

Coding fields on J1

Coding plug J1 is intended to prepare the connection of an external ON button to connector X2. Since acc. to the Machine Protection Regulations the DC link voltage of the Power Block may only be connected using on ON button, after connecting jumper J1 make absolutely sure that the ON button can no longer be operated (removing the pushbutton lines from connector X3, covering the actuating knob, etc.).

Coding jumper J2

This coding jumper can be used to determine the switching time of the output relay (see Section 4.6). You can choose between two operating states:

- **J2.1** The output relay will switch at the same time with the load relay of the Power Block. In this case, the output voltage (AC 230 V/50 Hz) is enabled by the safety relay.
- **J2.2** If coding jumper ‘2’ is connected, the output relay will switch immediately after turning on the transformer.

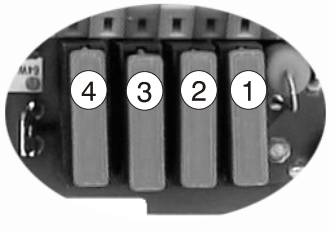
Coding jumper J3

This coding jumper is intended for extensions (if intended) and closed on Power Block PB xxx-C.

5.5 Fuses

Fuses F1 - F4

The DC link voltage is picked off from four separated WAGO terminal blocks. A maximum of four power output stages can be connected.
To protect the voltage output, a fuse (F1 - F4) is connected in series to each terminal block.
These are FKS-type fuses with a nominal value of 5 A (sluggish).



Fuses F1 - F4

Fuses F5 and F6

The fuses F5 and F6 are connected in series in the output line of the all-or-nothing relay (see Section 4.6), protecting the relay from overload. These are two fusible links to IEC-127 with a nominal value of 4 A (sluggish).

Temperature switch T1

Temperature switch T1 is connected in series in the primary winding of the tcoroidal-core current transformer. The temperature switch responds if the temperature exceeds 120 °C. After the transformer has cooled down to approx. 60 °C, the temperature switch is turned on automatically. The self-holding feature of the safety relay guarantees that the motor voltage is not enabled.

Since the primary circuit of the mains transformer is protected from overload merely with a temperature switch, you must install an additional primary fuse when installing the Power Block. When connecting the Power Block directly to the domestic electrical installation, a primary protection of the Power Block by fuses is provided by the fuse element (16 A) installed in the Power Block.

When integrating the Power Block into a control system (e.g. control cabinet), an additional primary fuse must be installed.

Use exclusively fuses to IEC-127. The fuses with a nominal value of 8 A should have a sluggish switching response.

Temperature switch T2

Temperature switch T2 is connected in series in secondary winding 2 (auxiliary voltage II) of the mains transformer. The response temperature of the switch is 120 °C.

Temperature switch T3

Temperature switch T3 is connected in series of secondary winding 3 (auxiliary voltage I) of the mains transformer. The response temperature of the switch is 120 °C.

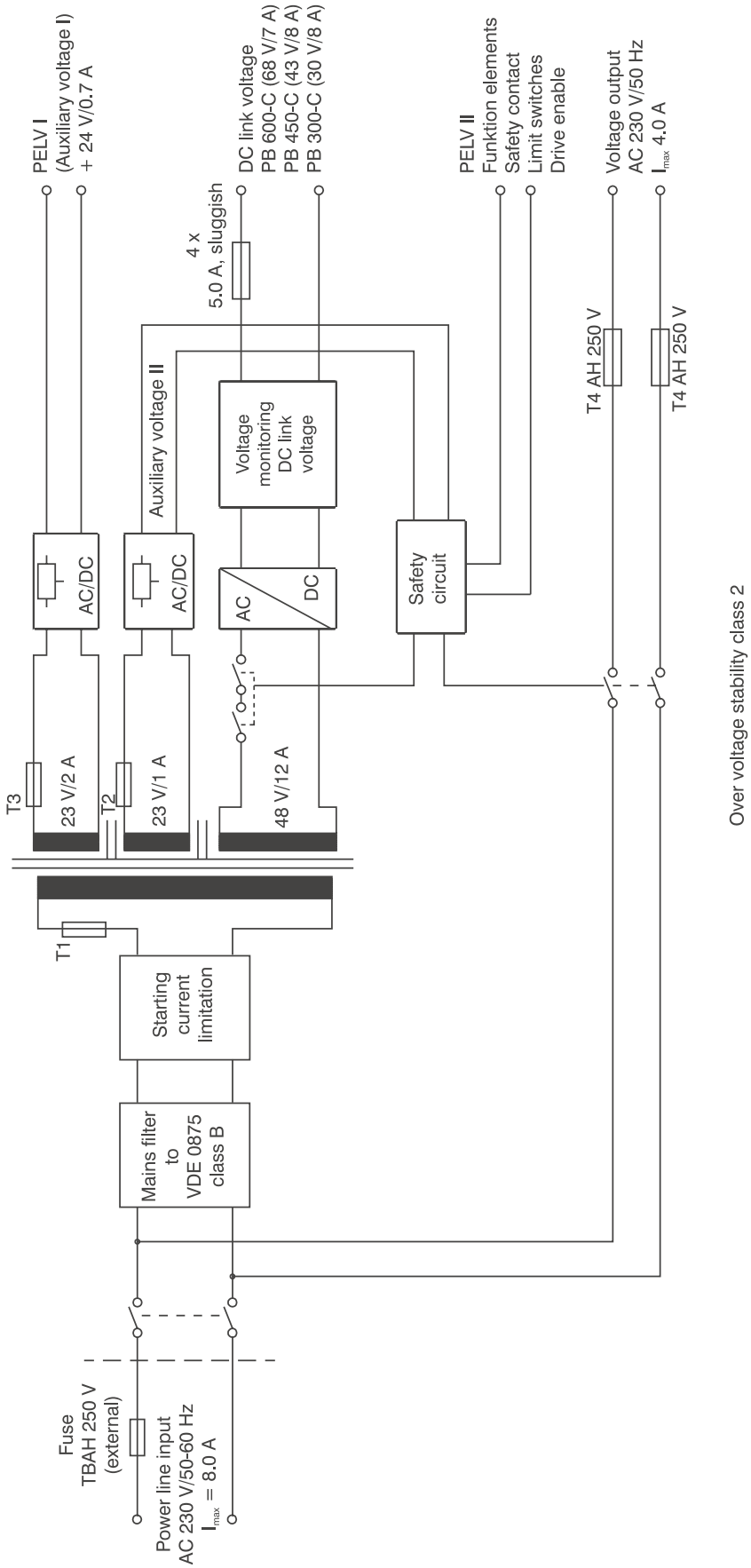
5.6 Voltage Output AC 230 V/50 Hz

For controlling an additional external device (input voltage AC 230 V/50 Hz , max. 4 A), the Power Block provides an appropriate output.
This output is connected by a load relay electronically coupled with the safety relay of the safety circuit. As a result, the output voltage is only available if all safety-relevant parts are enabled.

The voltage output is protected by two fuses T 4.0 A H 250 V (5 x 20 mm, IEC-127). A 3-core PVC-insulated line brought out from the housing via a PG-11 heavy-gauge conduit thread is used for connection.

If the output cable is connected later, a double-insulated line (no single lines) with a cross-sectional area of 1.0 mm should be used. Due to the PG-9 heavy-gauge conduit thread, the cable diameter should be within a range of 4 ... 8 mm.

6 Block Diagram of Model PB xx-C Powerblock



7 Circuit Documentation

7.1 *isel* Power Block Safety Circuit